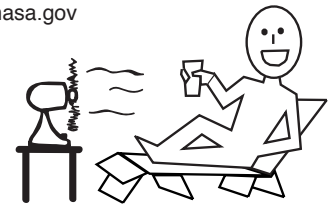
National Aeronautics and Space Administration
www.nasa.gov



S'COOL BREEZE

Engaging students in authentic science to advance our knowledge of Earth through
Students' **C**loud **O**bservations **O**n-**L**ine

Volume 3, Issue 13 *Explore. Discover. Understand.* **September 2005**

CERES: What Have We Learned?

by Lin H. Chambers, NASA Langley Research Center

In early 2005, the Terra spacecraft celebrated 5 years of measurements. With the CERES instrument on the TRMM spacecraft, we actually have measurements going back 8 years, to January 1998. The CERES instrument on TRMM failed early, due to an electronic problem, but the CERES instruments on Terra have demonstrated exceptional calibration stability, with absolute calibration of 0.5, 1.0 and 1.0 % for the three channels. This level of stability is necessary to tease out the small signals we are looking for in the Earth's energy balance.

One of the major goals of CERES is to provide information that will help constrain and improve the global climate models that are used to predict future climate. The CERES data from TRMM provide an excellent test case in this regard, as the TRMM dataset from 1998 starts during a strong El Nino event in January and ends with normal conditions in August. Climate models have been challenged to reproduce the strong El Nino signals in tropical cloud and radiation energy fields.

Tying CERES data to the earlier record from ERBE, we now have a 20-year record of radiation budget. This has allowed identification of some decadal scale signals that are not yet understood. They appear to result from slow changes in the earth's cloudiness. Because CERES data are combined with cloud physical properties from the high spatial and spectral resolution MODIS instrument

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S'COOL

In this Issue:

STUDENTS' CLOUD OBSERVATIONS ON-LINE

S'COOL: Where have we been? *Where are we going?*

by Lin H. Chambers, NASA Langley Research Center

In January 1997, we began a bold experiment: Could K-12 students provide useful information for ground truthing a NASA satellite instrument? From the very beginning, experiences with students indicated that the answer was "Yes". Since that time, S'COOL has collected more than 43,000 observations from around the world, with nearly 2000 participants now registered. CERES data have been processed in chunks, due to the rigorous analysis required for climate data. Thus, two major assessments have been made so far. An early assessment of the CERES data on TRMM provided limited but encouraging comparisons between ground and satellite data (http://asd-www.larc.nasa.gov/SCOOL/BAMS_cover.html). A more recent comparison of more than 9000 ground-to-satellite correspondences was made in 2004 (http://asd-www.larc.nasa.gov/SCOOL/usedata.html). Since then, many more CERES data have been processed, and the data are available (at the last URL) for you and your students to explore and explain.

The S'COOL Team 2005: (from left) Dr. Lin Chambers, Dave Young, Tina Rogerson, Kay Costulis, Roberto Sepulveda, Joyce Fischer, Susan Moore and on each end are the S'COOL kids representing the students who have embraced this project.

Along the journey we added some additional

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(validated in part by S'COOL observations), we can start to puzzle out these differences.

In studying climate, it is important to have multiple ways to measure parameters, to be sure that one really understands what is going on. Recently, we have been able to compare CERES data on net energy input to the Earth system with a completely independent measurement of ocean heat storage made by a combination of space-based and ocean-based sensors. The two results are remarkably consistent (Fig. 1) and suggest that there are not yet understood connections between the ocean and cloud changes (yes, clouds again!).

Looking forward, we are eagerly anticipating the launch this fall of Cloudsat and CALIPSO. These two active sensing platforms, one radar and one lidar, will join the CERES instrument on Aqua as part of the A-train constellation of satellites (Fig. 2). By sending radar and laser beams, respectively, into the atmosphere, these two satellites will provide unprecedented information about the vertical distribution of thin and thick clouds, and of aerosol (dust, smoke, pollution, etc.) layers in the atmosphere.

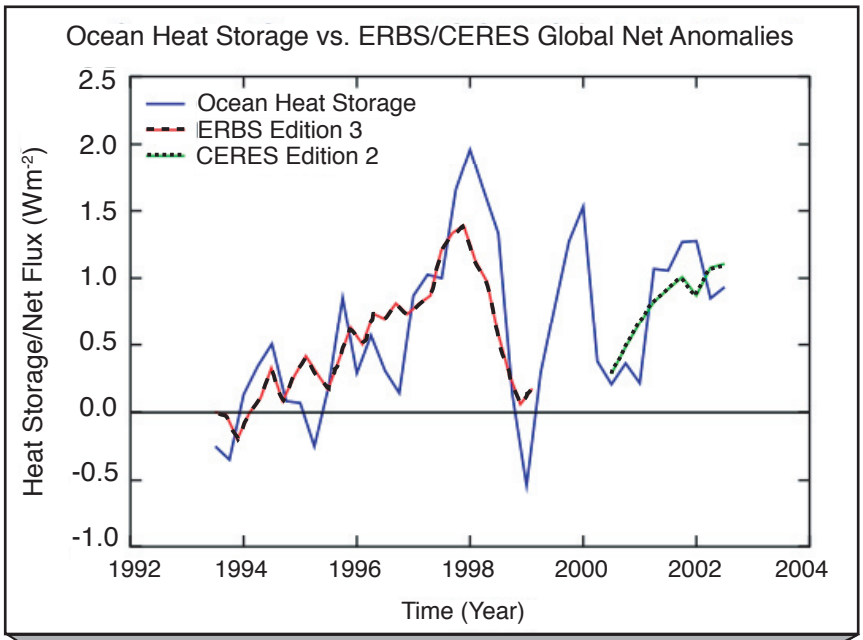


Figure 1. Comparing ERBE and CERES data with an independent measurement of heat storage for the Earth.

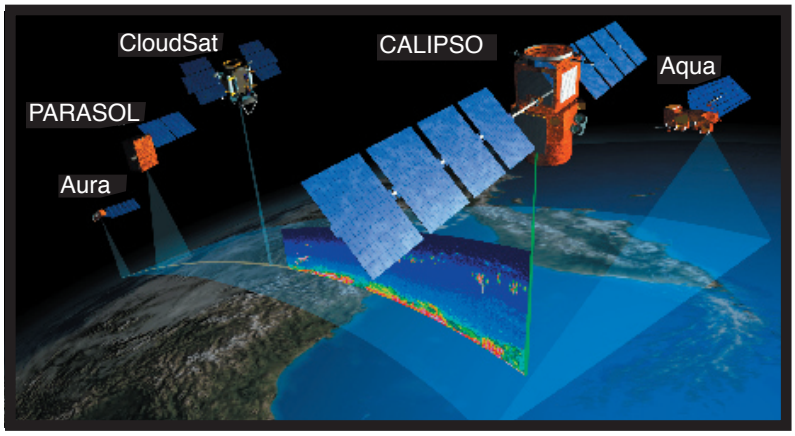


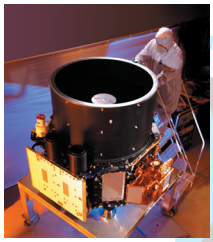
Figure 2.
The so-called A-Train is a flotilla composed of the Aqua, Aura, CloudSat, PARASOL and CALIPSO satellites flying in formation in low polar orbits 438 miles (705 km) above Earth. Together, their overlapping science instruments give a comprehensive picture of Earth weather and climate.

The satellites are referred to as the A-Train because the caravan has been said to resemble a train of satellites flying around Earth. However, the railroad metaphor doesn't give an accurate picture. The satellites do not follow each other in single file. Rather, they fly independently and cross over the equator a few minutes apart starting just after 1:30 p.m. local time.

The A in A-Train also stands for "afternoon" because the satellites cross the equator shortly after noon. Aqua leads the train. It is the largest satellite in the group and the first to cross the equator each day and night (about 1:40 p.m. and 1:40 a.m.).

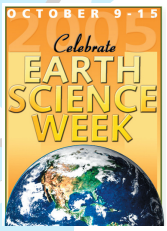
The spacecraft travel around the planet at more than 15,000 mph. Ground controllers maintain their orbits within 15 minutes of the leading and trailing satellites. CloudSat and CALIPSO will fly within 15 seconds of each other, so they can measure the same clouds at the same time.

Quarter's Worth of Websites



Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO): http://www-calipso.larc.nasa.gov/
The CALIPSO satellite will provide new insight into the role that clouds and atmospheric aerosols (airborne particles) play in regulating Earth's weather, climate, and air quality. CALIPSO will combine an active lidar instrument with passive infrared and visible imagers to probe the vertical structure and properties of thin clouds and aerosols over the globe. This website contains animations of the A-Train constellation and information about education outreach.

Earth Science Week 2005: http://www.earthsciweek.org/
This year Earth Science Week will take place on October 9-15, 2005, and will focus on Earth Science Careers. Learn about what geoscientists do and how their work is important to society. Visit this site to see what events will be going on in your area and to find out how to get your 2005 ESW kit. In addition, there is a link to teacher resources and information on how to get your students involved in national contests being held that week.



Return To Flight: http://www.nasa.gov/returntoflight/main/
Welcome to NASA's Return to Flight Web coverage. Here's where you'll find everything on Discovery's mission. Find out information concerning the Space Shuttle, the launch, the landing, and the STS-114 crew. Read about the tribute given to the fallen astronauts and cosmonauts. Also, be sure to visit the video and the image galleries for multimedia that is 'out of this world.'

(continued from page 1 - S'COOL: Where...we going?)

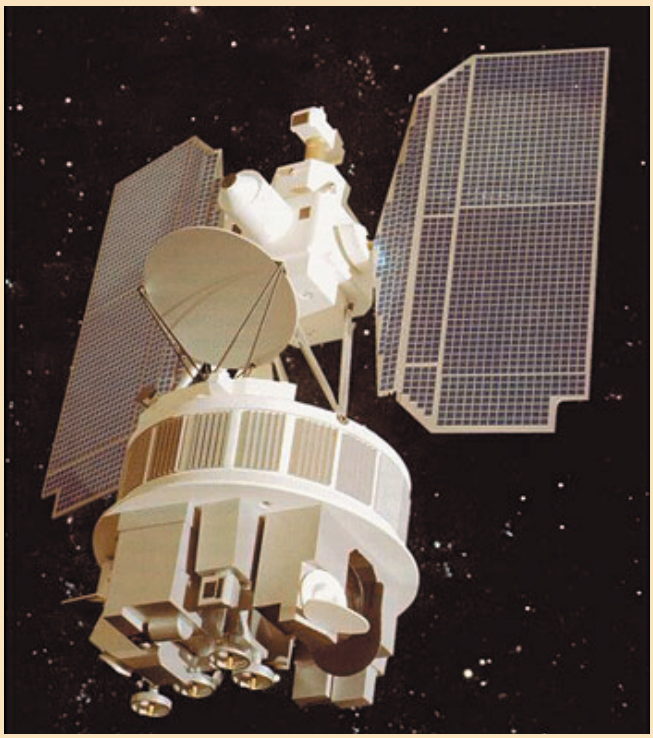
questions to our experiment: Can teachers make use of the S'COOL Project? Are students interested? Does learning occur? While the answers to those questions are by no means final, your involvement gave us the incentive to continue.

Today, we find ourselves at something of a crossroads for S'COOL. The CERES project is in a shrinking phase (although analysis and understanding of the CERES data is only in its infancy). Some questions have been answered, but many remain. To make the most of resources that are becoming more limited, we are making some changes to S'COOL. For one, this is the last issue of the S'COOL Breeze that will arrive in your mailbox. In the future, we will be using email and the website to communicate with you. For another, we will be looking for ways to leverage the S'COOL network to address emerging questions, such as providing ground truth for the new generation of active remote sensing satellites, beginning this fall with Cloudsat and CALIPSO.

Aside from these changes, the S'COOL project should remain in its familiar form. Our website and web forms will remain in place, and someone will still be here to help you with questions. Cloudsat and CALIPSO will be flying in formation with Aqua, so your Aqua overpass schedule becomes doubly or triply valuable.

On the satellite data front, we have some excellent news. First, the Terra spacecraft has just been approved for a two-year mission extension, with another two years likely after that. The Aqua spacecraft, of course, is still in its primary mission. Second, a new project called FLASHFlux is adapting the CERES algorithms to run much more quickly. Satellite information on clouds should be available on the S'COOL website about 5 days after the satellite makes the measurement. The results will be preliminary, but we think the ability to compare your students' observation reports to a satellite retrieval within a week or so will more than compensate for any small reduction in accuracy.

We hope that you will stick with us, and encourage others to join us as we scientists, educators, and students together continue our journey of discovery.



Teacher Corner

Over 1925 participants are now registered.
Keep spreading the word!

Have you changed your school information? Please remember to notify us of any changes in your school information or e-mail address.

Are you ready for comparisons?

Many or you have been asking and now, thanks to a new feature, S'COOL participants will have the opportunity to compare their ground observations to the satellite retrieved data within days. Keep posted for an upcoming announcement with more information about this new feature.

Don't Forget! Daylight Savings Time will soon be over!
Remember to request your satellite overpass schedule for the new times beginning October 30th.

Thank you for your continuted participation!

Another CERES PLAYER

Spotlight on Atmospheric Careers

Kay Costulis
Computer Engineer
CERES Data Mgmt. Team

Responsible for developing and enhancing CERES products and maintaining the CERES and S'COOL websites.

Born 1961 in Poquoson, Virginia

Education:
Bachelor of Science in Computer Science

Favorite School subject(s):
Math and Computer Science

Favorite Hobbies:
Attending my children's sports activities, reading, and knitting & tatting

What do I like most about my job:
The challenge of simplifying tasks using computer programs.

What advice do I have for someone interested in an Atmospheric Science Career:
Always be willing and ready to change. In today's fast moving technical environment, nothing stays the same for long and you either change and adapt or you're left behind.

NASA STEMS

NASA Science Trivia to Excite & Motivate Students

Many of you are probably aware of the Earth Observing System satellites that monitor land, sea and atmosphere for changes in the environment. In fact, many of you may be aware that NASA planned this series of satellites known as EOS at the suggestion of the first American woman in space, Sally K. Ride. Astronaut Ride envisioned a 'Mission to Planet Earth' to preserve our planet through coordinated research into Earth's global environment. But how many of you are aware of the Nimbus series of missions that started in 1964? These missions represented the United States' primary research and development platform for satellite remote sensing of the Earth. Pictured here is an artist's drawing of the general design of the Nimbus series of satellites. For more information about the Nimbus Project's history visit the Earth Observatory at: http://earthobservatory.nasa.gov/Study/Nimbus/

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UPCOMING EVENTS

Education and Public Outreach Conference
September 14-16, 2005
Tuscon, AZ, USA

Intensive Observation Period
Earth Science Week 2005
October 9-15, 2005
World-wide

NSTA Eastern Regional Conference
October 20-22, 2005
Hartford, CT, USA

NSTA Midwestern Regional Conference
November 10-12, 2005
Chicago, IL, USA

http://asd-www.larc.nasa.gov/SCOOL/visits.html

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Roberto Sepulveda, editor
Dr. Lin Chambers, French translator
Roberto Sepulveda, Spanish translator

Happy in Argentina!

"It's has been two weeks since we began sending in data; the students are very happy. I want to thank you for the Spanish materials you have sent especially since we don't rely on economic possibilities to acquire bibliographic or instrumental materials. Thus the students are very happy with the cloud ID charts and the possibility of doing some of the activities which appear on your website."

Claudia Romagnoli, teacher, Escuela EGB 1345 Pujato (Santa Fe) Argentina